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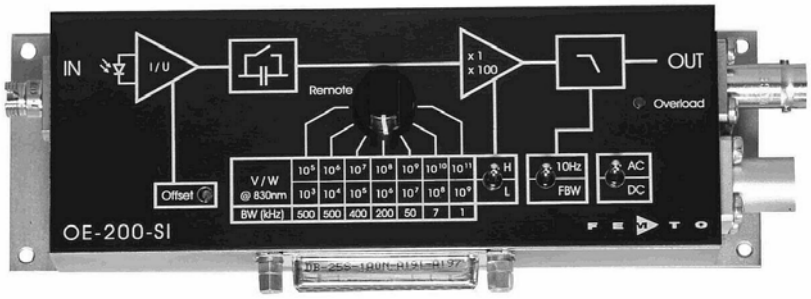
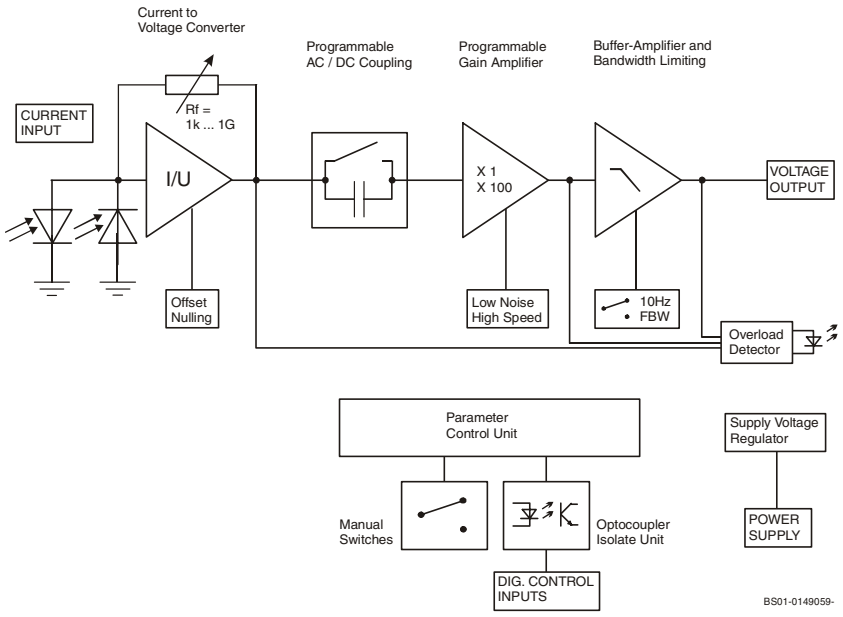
Datasheet — OE-200-S Ser.No. 08-39-023

Variable-Gain, Balanced Photoreceiver
(Customized Version)



(Picture shows a similar unbalanced model with single photodiode input)

Features	• **Balanced Si PIN Detectors with Ø 1.2 mm Active Diameter** • **Spectral Range 320 - 1060 nm** • **Conversion Gain Switchable from 1 x 10^3 to 1 x 10^{11} V/W** • **Bandwidth up to 500 kHz** • **Local and Remote Control**
Applications	• **Spectroscopy** • **General-Purpose Opto-Electronical Measurements** • **Optical Receiver for Use with Lock-In Amplifiers**
Block Diagram	

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Specifications	*Test Conditions*	*Vs = ± 15 V, Ta = 25°C*
Gain	Conversion Gain	1 x 10^3 ... 1 x 10^{11} V/W (@ 830 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy	± 15 % electro optical (Popt ≤ 1 mW, @ 830 nm)
	Gain Drift	see table below
Frequency Response	Lower Cut-Off Frequency	DC / 1 Hz, switchable
	Upper Cut-Off Frequency	up to 500 kHz (see table below), switchable to 10 Hz
	Gain Flatness	± 0.1 dB
Input	Noise Equivalent Power (NEP)	see table below
	Max. CW Saturation Power	see table below
	Common Mode Rejection	> 45 dB typ.
	Offset Current Compensation	± 600 pA, adjustable by offset trimpot or ± 400 pA, adjustable by external control voltage
Detector	Detector	2x Si PIN photodiodes in free space flanges
	Active Area	∅ 1.2 mm
	Spectral Response	320 – 1060 nm
	Sensitivity	0.6 A/W (@ 830 nm)
	Dark Current	4 pA typ.

Performance depending on Gain Setting

Gain Setting (Low Noise) (V/W)	10^3	10^4	10^5	10^6	10^7	10^8	10^9
Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	50 kHz	7 kHz	1.2 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
NEP (/√Hz, @ 500 Hz, 830 nm)	80 pW	8 pW	1.1 pW	350 fW	110 fW	36 fW	16 fW
Offset Current Drift (/°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
Gain Drift (/°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
cw-Saturation Power	2 mW	1 mW	0.1 mW	10 µW	1 µW	0.1 µW	10 nW

Gain setting (High Speed) (V/W)	10^5	10^6	10^7	10^8	10^9	10^{10}	10^{11}
Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	50 kHz	7 kHz	1.2 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
NEP (/√Hz, @ 500 Hz, 830 nm)	50 pW	6 pW	1.2 fW	360 fW	110 fW	38 fW	16 fW
Offset Current Drift (/°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
Gain Drift (/°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
cw-Saturation Power	0.1 mW	10 µW	1 µW	0.1 µW	10 nW	1 nW	0.1 nW

Output	Output Voltage	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
	Max. Output Current	± 30 mA
Indicator LED	Function	overload
Digital Control	Control Input Voltage Range	LOW bit: - 0.8 ...+ 1.2 V, HIGH bit: + 2.3 ... + 12 V
	Control Input Current	0 mA @ 0 V, 1.5 mA @ + 5 V, 4.5 mA @ + 12 V
	Overload Output	non active: 0 V , max. - 1 mA, active: 5.1 V, max. 7 mA
Ext. Offset Control	Control Voltage Range	± 10 V
	Offset Control Input Impedance	20 kΩ
	Conversion Factor	40 pA/V

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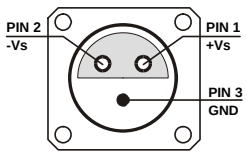
Specifications (continued)

Power Supply	Supply Voltage	± 15 V
	Supply Current	+ 110 / - 80 mA (depends on operating conditions, recommended power supply capability min. ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5V, max. 50 mA
Case	Weight	320 g (0.74 lb.)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	- 40 ... + 80 °C
	Operating Temperature	0 ... + 60 °C

Absolute Maximum Ratings	Max. CW-Power (Averaged)	20 mW
	Digital Control Input Voltage	- 5 V / + 16 V relative to digital ground DGND (pin 9)
	Analog Control Input Voltage	± 15 V relative to analog ground AGND (pin 3)
	Power Supply Voltage	± 22 V

Connectors	Input	optical, 2x free space
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND



	Control Port	Sub-D 25-pin, female, Qual. Class 2 Pin 1: + 12 V (stabilized power supply output) Pin 2: - 12 V (stabilized power supply output) Pin 3: AGND (analog ground) Pin 4: + 5 V (stabilized power supply output) Pin 5: digital output: HIGH = overload Pin 6: signal output (connected to BNC) Pin 7: NC Pin 8: input offset control voltage Pin 9: DGND (ground for digital control pins 10 - 14) Pin 10: digital control input: Gain, LSB Pin 11: digital control input: Gain Pin 12: digital control input: Gain, MSB Pin 13: digital control input: AC/DC Pin 14: digital control input: high speed / low noise Pin 15 - 25: NC

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Remote Control Operation

General

Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to “Remote”, "AC" and "H” and select the desired setting via a bit code at the corresponding digital inputs.
Mixed operation, e.g. local AC/DC setting and remote controlled gain setting, is also possible.

The switch setting “FBW / 10 Hz” of the low pass signal filter is not remote controllable.

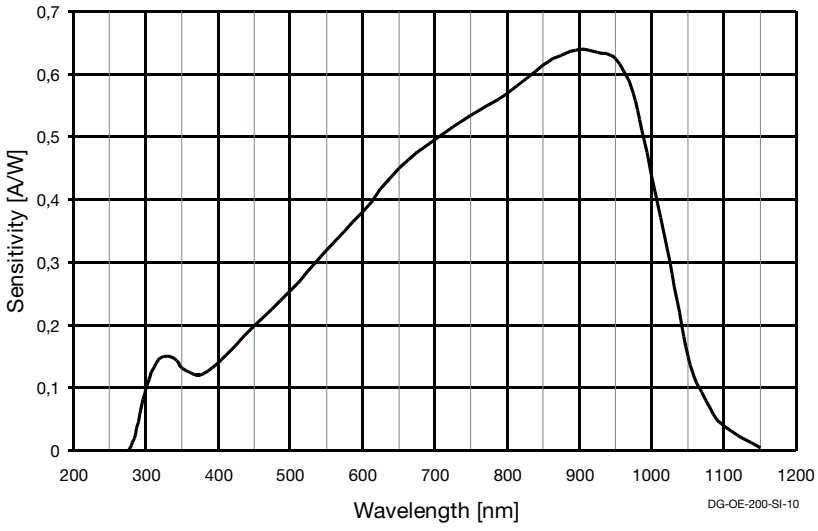
Gain Setting

Low Noise Gain (V/W) Pin 14=HIGH	High Speed Gain (V/W) Pin 14=LOW	Pin 12 MSB	Pin 11	Pin 10 LSB
10^3	10^5	LOW	LOW	LOW
10^4	10^6	LOW	LOW	HIGH
10^5	10^7	LOW	HIGH	LOW
10^6	10^8	LOW	HIGH	HIGH
10^7	10^9	HIGH	LOW	LOW
10^8	10^{10}	HIGH	LOW	HIGH
10^9	10^{11}	HIGH	HIGH	LOW

AC/DC Setting

Coupling	Pin 13
AC	LOW
DC	HIGH

Spectral Response



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Typical Performance Characteristics

Typical Common Mode Rejection

Using a balanced photoreceiver with equal optical input power on both photodiodes will reduce a common mode signal present on both signal paths. The common mode rejection (CMR) is a measure for the effectivness of the balanced operation.

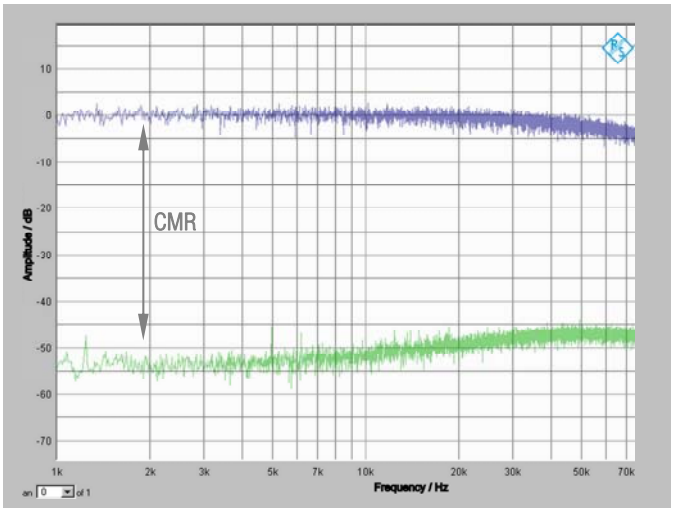
Common mode rejection is calculated as follows:

$CMR = 20 \log (U_{out, PD1} / (U_{out, PD2} - U_{out, PD1}))$,

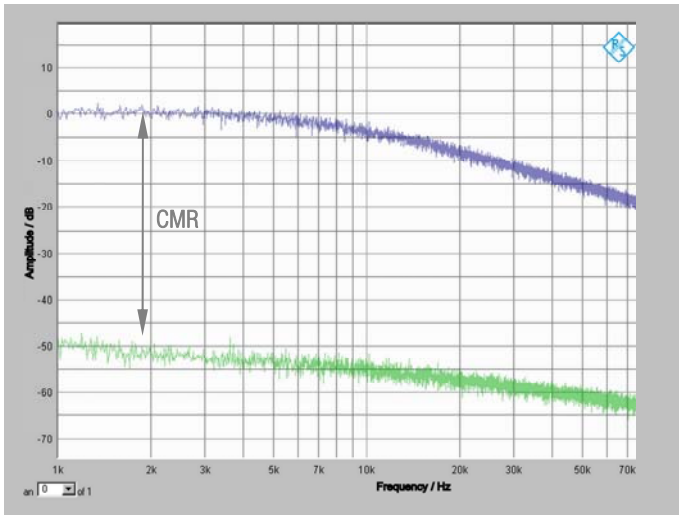
where
$U_{out, PD1}$ is the output voltage generated by the optical signal on the 1st photodiode
$U_{out, PD2}$ is the output voltage generated by the optical signal on the 2nd photodiode

Example Plots of CMR

The plot shows the output signal generated by the 1st photodiode (blue-curve) and the differential (balaced) signal (green-curve) at an amplifier setting of L 10^7 V/W, FBW, DC



The plot shows the output signal generated by the 1st photodiode (blue-curve) and the differential (balanced) signal (green-curve) at an amplifier setting of L 10^8 V/W, FBW, DC



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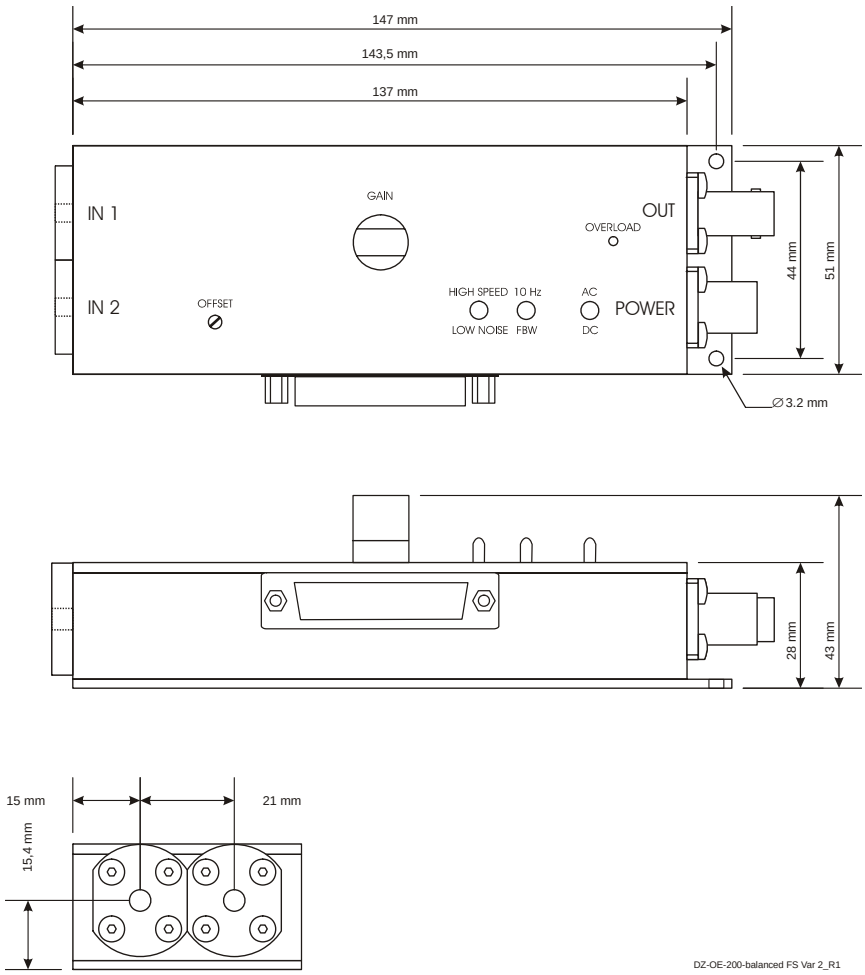
Dimensions



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